Computer Aided Drafting – CAD

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Introduction

Computer Aided Drafting is a process of preparing a drawing using a computer.

In the field of **Mechanical Engineering**, the drawing of machine components and layouts are prepared.

In the field of **Civil Engineering**, plans and layouts of the buildings are prepared.

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Introduction

CAD provides **enhanced graphics capabilities**

- Ease of conceptualization
- Drawing can be modified easily
- Different types of animations
- Estimation of bulk materials required
- Calculation of finished surface areas and volumes
- Colors, fonts and other aesthetic features may also be used

History of CAD

1. Charles Barbage (**1883**) - developed the idea for computer.
2. 1st CAD demon was by Ivan Sutherland (**1963**) - SKETCHPAD.
3. A year later IBM produced the first commercial CAD system.

Examples of CAD software

DWGeditor, AutoCAD, PRO/Engineer, IDEAS, UNIGRAPHICS, CATIA, SolidWorks, Patran, Hypermesh, etc.

Advantages of CAD

- **Easier Creation and Corrections** - Working/detail drawings may be created more quickly and makings changes is more efficient than correcting drawings made by hand.
- **Better Visualization of drawings** - It allows different views of the same object and 3D pictorial view.
- **Database of Drawing Aids** - Designs and symbols can be stored for easy recall and reuse.
- **Increased Accuracy** - Drawings may be prepared with accuracy of decimal places of mm.
- **Improved Filing** - Drawings can be more conveniently filed, retrieved and transmitted on disks and tape.
- **Quick Design Analysis, Simulation and Testing**.

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Software Installation

Installation Instruction

- http://www.cic.iitkgp.ernet.in/software/solid.php
-
- Install **DWG Editor** – the 2D CAD software. It can also be downloaded from the website and the key listed in above mentioned server may be used to register it.
-
- Install **Solidworks** as per your system requirements

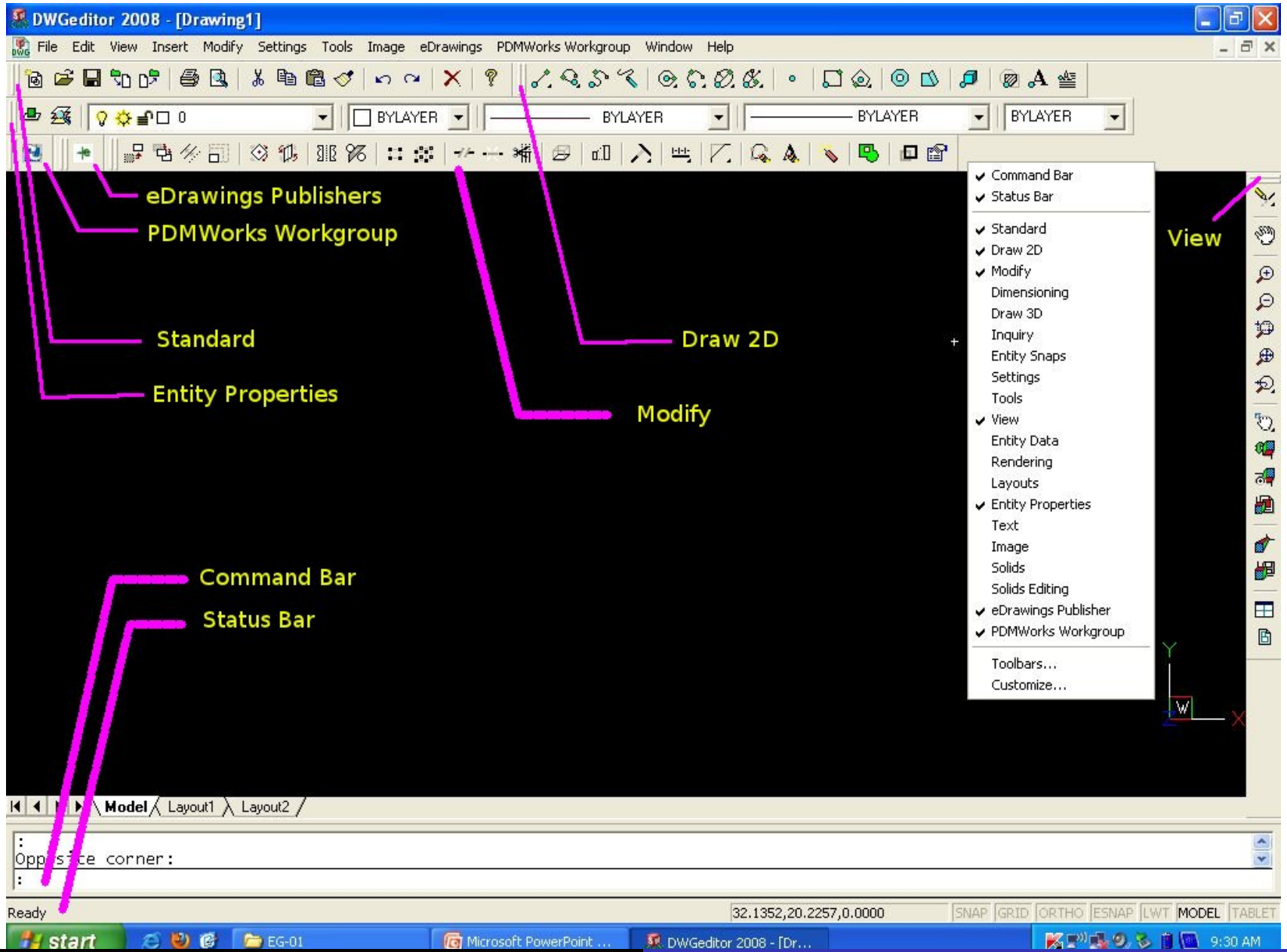
DWGeditor

DWGeditor is a drawing software for drawing architectural drawings, electrical schematics, mechanical drawings etc..

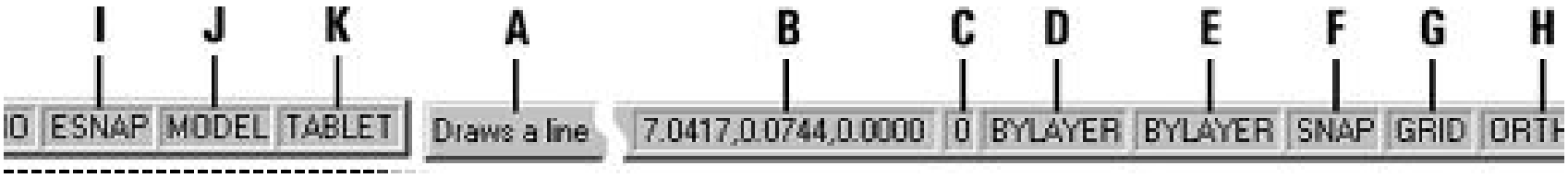
Concept of scale

1. **No** need to choose **scale.** Everything will be drawn in full scale.
2. We need to decide the **scale for taking printout**.
3. Advantages are :- **No compensation due to scale** for measurement of lengths, areas, volumes etc.

DWGeditor


DWGeditor 2008 - [Drawing1]
File Edit View Insert Modify Settings Tools Image eDrawings PDMWorks Workgroup Window Help
eDrawings Publishers
PDMWorks Workgroup
Standard
Entity Properties
Draw 2D
Modify
View
Command Bar
Status Bar
Command Bar
Status Bar
Standard
Draw 2D
Modify
Dimensioning
Draw 3D
Inquiry
Entity Snaps
Settings
Tools
View
Entity Data
Rendering
Layouts
Entity Properties
Text
Image
Solids
Solids Editing
eDrawings Publisher
PDMWorks Workgroup
Toolbars...
Customize...
Model Layout1 Layout2
Opposite corner:
Ready
32.1352,20.2257,0.0000
SNAP GRID ORTHO ESNAP LWT MODEL TABLET
start
EG-01
Microsoft PowerPoint ...
DWGeditor 2008 - [Dr...
9:30 AM

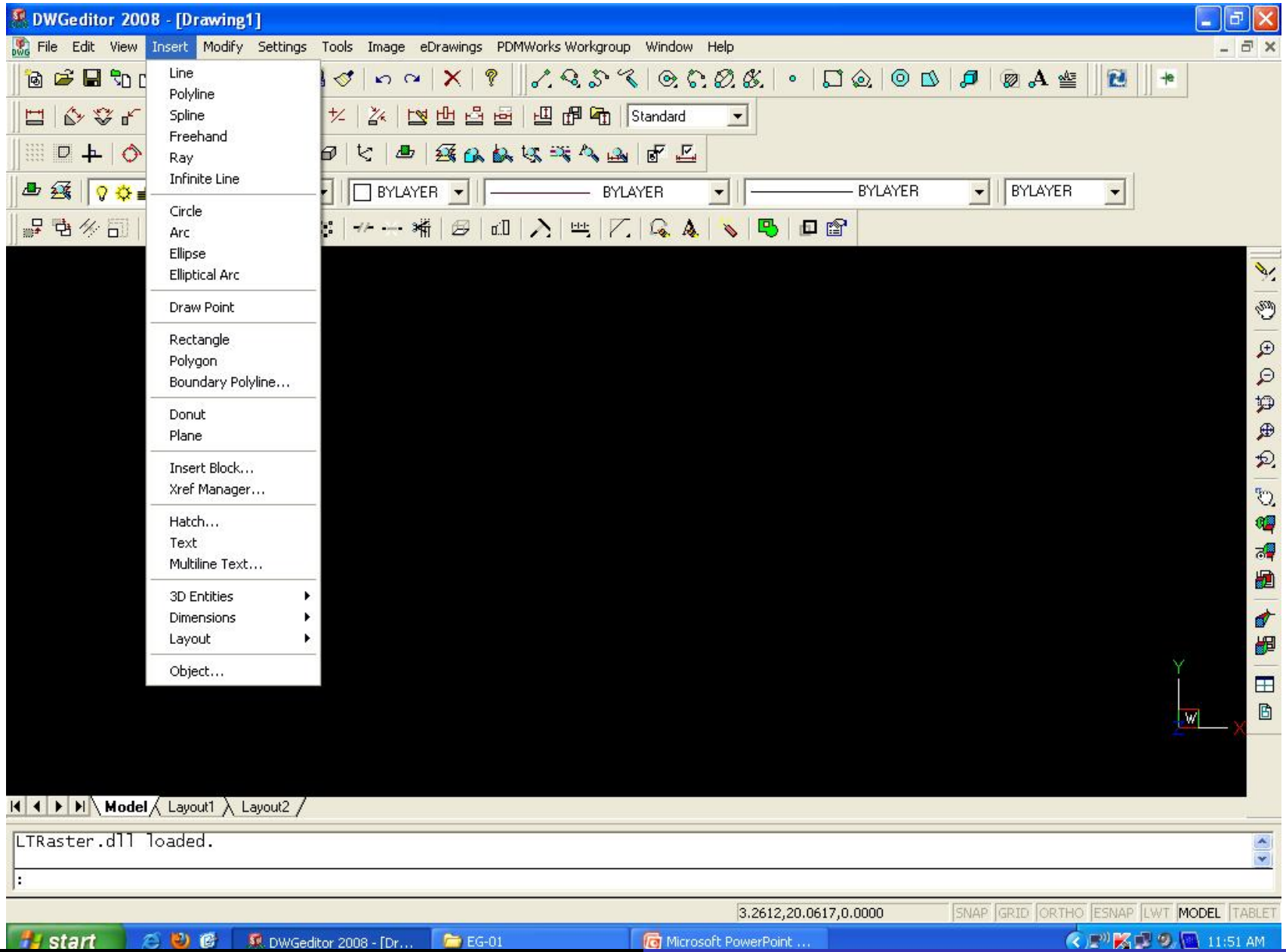
DWGeditor



Status Bar

- A Information about the current command.
- B Cursor coordinates (x,y,z).
- C Layer name. Double-click to change layers.
- D Drawing color. By default, the color is BYLAYER. Double-click to change colors.
- E Linetype. By default, the linetype is BYLAYER. Double-click to change linetypes.
- F Snap setting. Double-click to toggle on or off.
- G Grid setting. Double-click to toggle on or off.
- H Orthogonal setting. Double-click to toggle on or off.
- I Entity snap setting. Double-click to select entity snaps.
- J Space mode setting. Double-click to select tile mode, model space, or paper space.
- K Digitizer mode. Double-click to toggle on or off.

DWGeditor Commands



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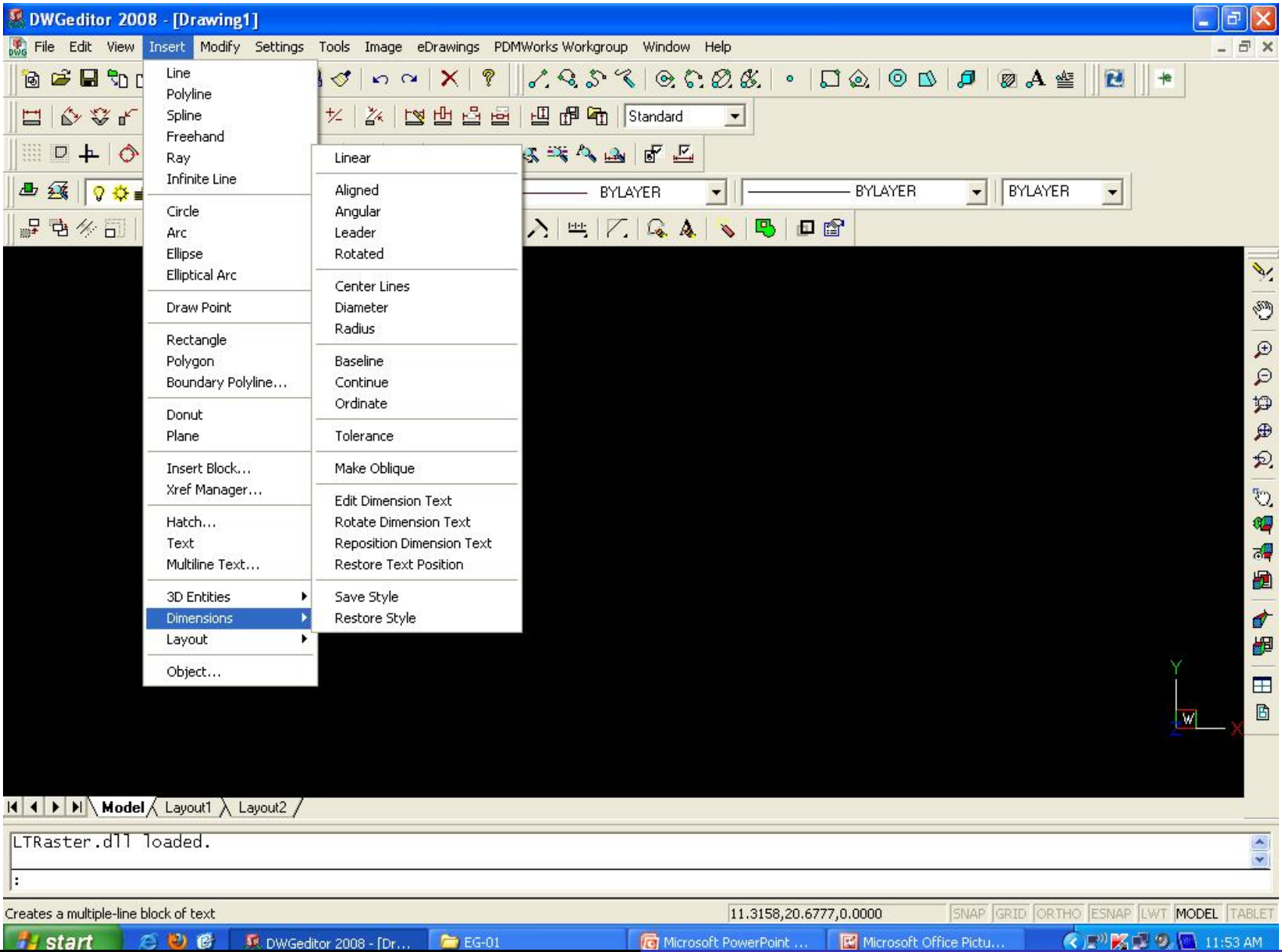

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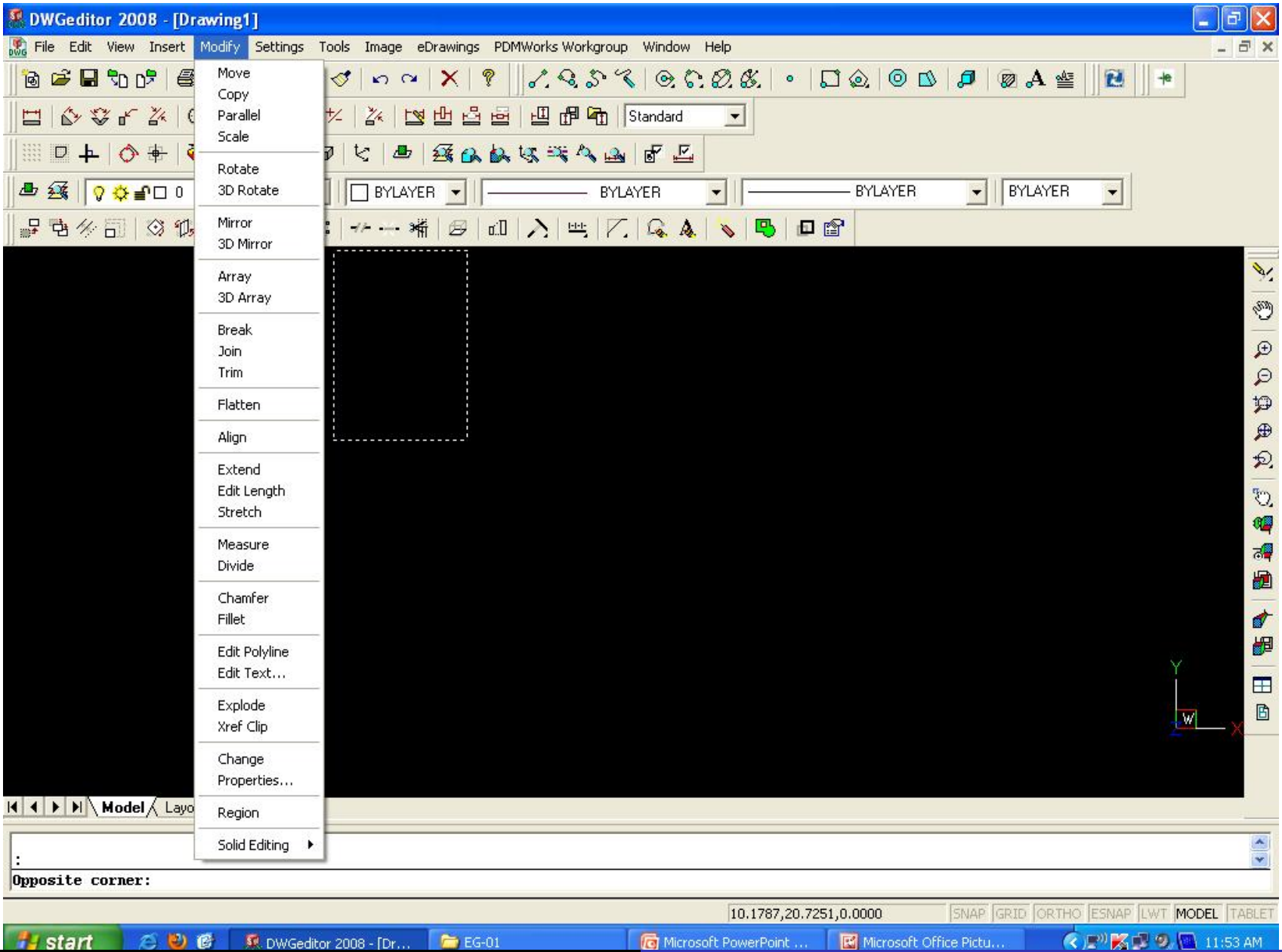

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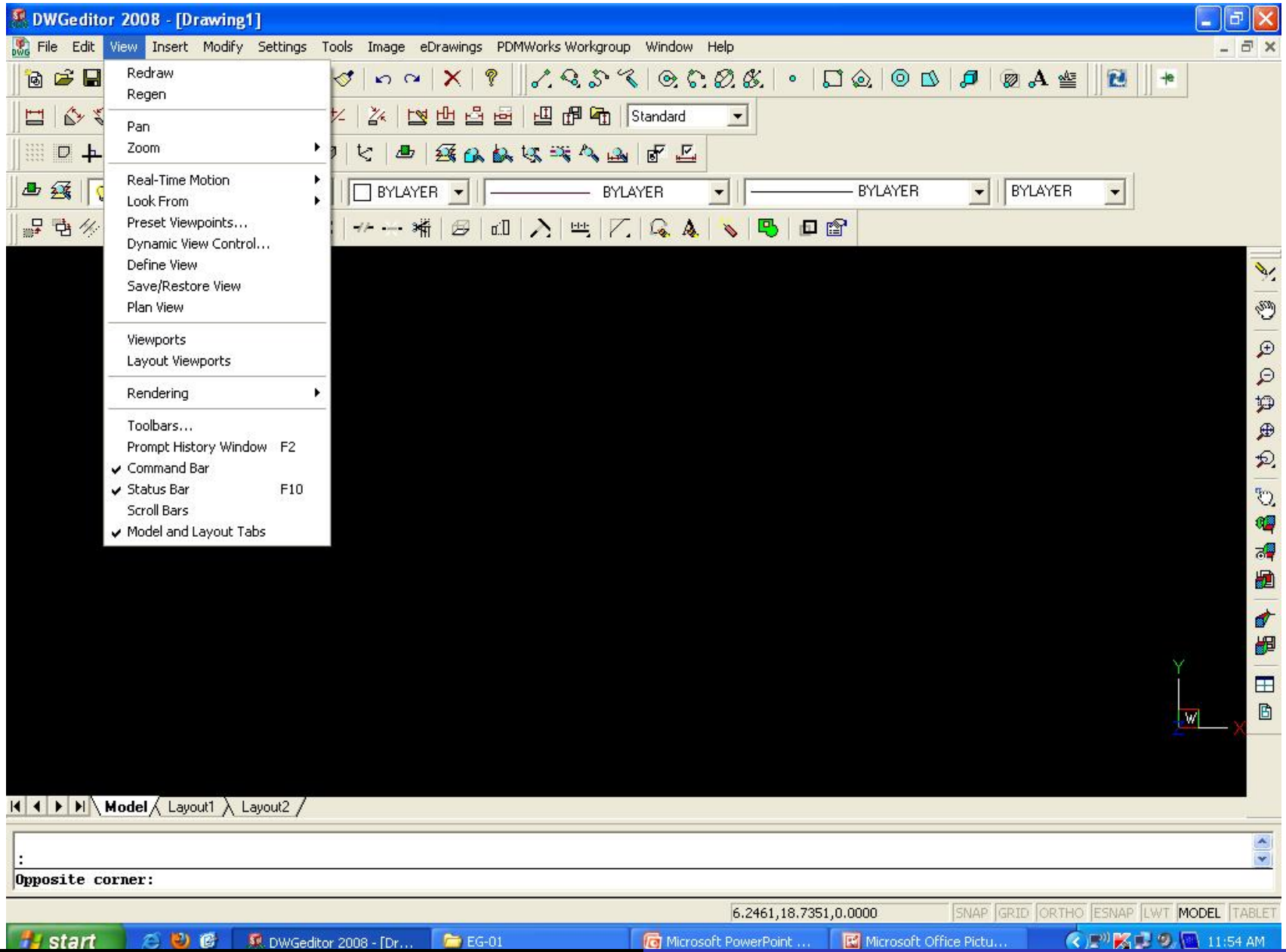


Setting Units

Settings $\Longrightarrow$ Drawing Settings $\longrightarrow$ drawing units
Command line $\Longrightarrow$ units

Setting Area

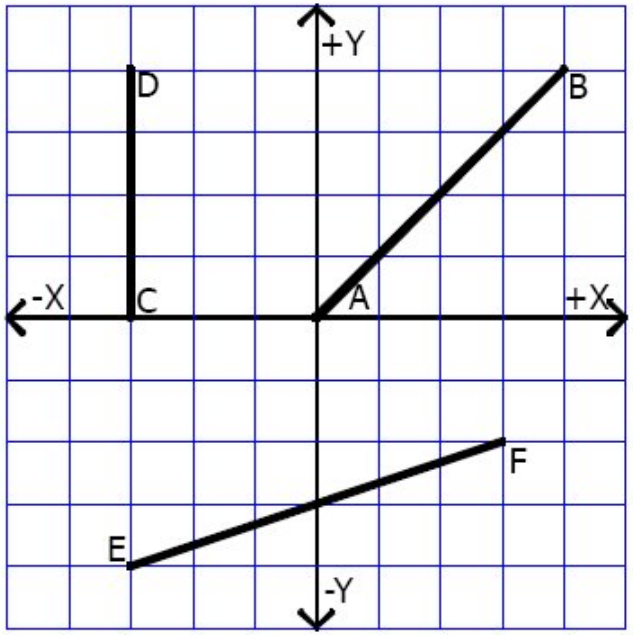
Settings $\Longrightarrow$ Drawing Limits
Command line $\Longrightarrow$ limits

Point

Methods to locate a point

1. **Interactive**:- Click a point on the screen. Use **snap, grid, esnap** for accuracy
2. **Absolute Cartesian Co-ordinate**:- X,Y
3. **Relative Cartesian Co-ordinate**:- @X,Y
4. **Relative Polar Co-ordinate**:- @*distance*<*angel*
5. **Direct Distance**:- Move the courser in the direction and type the distance on the command line. Use *ortho or polar* tracking.

Point Examples



To Point B from Point A:

Absolute Cartesian coordinates: 0,0 (A) and 4,4 (B)

Relative Cartesian coordinates for Point B: 0,0 (A) and @4,4 (B)

Interactive method with Snap and Grid set to 1

To Point D from Point C:

Absolute Cartesian coordinates: -3,0 (C) and -3,4 (D)

Relative Cartesian coordinates for Point D: -3,0 (C) and @0,4 (D)

Interactive method with Snap and Grid set to 1

Line

erase all

Example -1

1. Type 'line' and enter
2. 2,2 enter
3. 8,2 enter
4. 8,7 enter
5. 2,2 enter
6. enter
7. 2,2 enter
8. @6,0 enter
9. @0,5 enter
10. @-6,-5 enter

Polar Coordinate

1. Three o'clock as the direction of the 0^0 angle
2. all other directions are determined counterclockwise
3. line enter
4. 2,2 enter
5. @6<0 enter
6. @5<90 enter
7. @7.8125<219.8056 enter **or** close
8. undo enter *(to undo last step)*

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Line

Movie for illustration

DWGeditor Commands

Important commands

line Draws straight lines of any length. You can specify the two-dimensional or three-dimensional coordinates for the start or endpoints by entering the x,y,z-coordinates of the point.

polyline Draws two-dimensional polylines (connected line and arc segments) with optional width and taper.

spline Draws a free-form curve. To convert a polyline to a spline, use Polyline Edit .

circle Draws a circle of any size. The default method of drawing a circle is by center point and radius, but there are other methods you can use.

arc Draws an arc of any size.

DWGeditor Commands

Important commands

freehand	Allows you to sketch by drawing short line or polyline segments as quickly as you move the input device.
text	To enter text entity.
dim	Dimensions drawing entities in a variety of ways.
vpoint	Various view styles.
erase	To erase entities.
break	Splits an entity into two entities. You can split, or remove the ends from, lines, arcs, circles, polylines, infinite lines, rays, ellipses, splinesand donuts.

DWGeditor Commands

Important commands

trim Erases the portions of selected entities that cross a specified boundary. You can trim lines and open two- and three-dimensional polylines, rays, arcs, and circles. Entities that you can use as the cutting entities are arcs, circles, lines, polylines, rays, infinite lines, and viewports in paper space.

fillet Creates a fillet, or rounded corner, at the intersection of two lines, rays, or infinite lines. If the entities you want to fillet do not intersect, they are trimmed or extended until they can be filleted.

DWGeditor Commands

Important commands

extend Lengthens a line, an arc, a two-dimensional polyline, or a ray to meet another entity. You can use polylines, arcs, circles, ellipses, infinite lines, lines, rays, splines, or viewports in paper space as bounding entities. When you use a two-dimensional polyline as a bounding entity, entities are extended to the center line of the polyline.

move Moves selected entities to another location in the same drawing.

scale Changes the scale of existing entities, either enlarging them or reducing them proportionately in x, y, and z directions. A scale factor greater than 1 enlarges the entities; a scale factor between 0 and 1 reduces them.

DWGeditor Commands

Important commands

rotate Rotates existing entities around a specified point.

copy Draws a duplicate of the selected entities. You can draw multiple copies from a single selection, and you can specify the base and displacement points. The entities you select to copy are not moved from their original location. The entities you copy maintain all the attributes (such as linetype, color, and layer) of the original entities.

linetype Defines linetypes (sequences of alternating line segments, dots, and spaces), loads them from libraries, and sets the current linetype.

ltscale Defines linetypes (sequences of alternating line segments, dots, and spaces), loads them from libraries, and sets the current linetype.

DWGeditor Commands

Important commands

limits Changes the Grid and Zoom ¿ All boundaries. Limits are two-dimensional points representing the lower left and upper right limits in the World Coordinate System (WCS).

zoom Enlarges or reduces the display of the active drawing. To examine a drawing more closely, you can zoom into it. Doing this makes the drawing appear larger on the screen so you can see more detail. When you zoom in or out, you enlarge or reduce the display in five-percent increments.

ellipse Draws ellipses and elliptical arcs. You can draw ellipses or elliptical arcs dynamically by specifying the major and minor axes or by specifying the center point.

DWGeditor Commands

Important commands

rectangle Draws a rectangle. A rectangle is a polyline entity.

polygon Draws polygons with a specified number of sides. A polygon is created from a polyline entity. The default width of the polygon is specified with the PLINEWID system variable, but you can change the width when you draw a polygon.

donut Draws a filled circle or flat ring created as a polyline. You can use the system variable FILLMODE to specify whether the donuts you create are filled. To retain the fill, set the FILLMODE variable to 1; to remove the fill, set the FILLMODE variable to 0.

mirror Moves or copies the reflected image of selected entities about a line.

DWGeditor Commands

Important commands

offset	Creates a parallel or offset copy of curves and lines.
units	Displays the Prompt History window, which shows each of the measurement units and their respective measurements for the selected entity. Select unit measurement options from the prompt box. To see the choices for the prompts that follow, leave the Prompt History window turned on.
ucsicon	Turns the display of the UCS icon on or off, and controls where in the viewport the icon displays.
ucs	Defines or modifies the current user coordinate system. You can use the UCS to create a system for entering coordinates and planes and for viewing drawings. This command defines the UCS in three-dimensional space.

Isometric in 2D

Suggestions

1. Use the "Relative Polar Co-ordinate Method" (@*length*,< *angle*
2. Draw the square which encircle the circle.
3. Use four center method to complete the ellipse.

Ellipse in Isometric View

Suggestions – 1

- Use the four center method.

Suggestions – 2

1. Use "Ellipse Center-Axes" method to draw an ellipse with coinciding center of the diagonal of the rhombus.
2. Select the ellipse and open properties.
3. Change the "Axis Ratio" to 0.625 and 'OK'
4. Drag the extreme end of the ellipse on the diagonal to make it tangent to the rhombus.
5. Remember to turn on the "ESNAP" with all options.
6. Use "Center, Axis and Angle" to draw partial ellipse.

Movie

Movie for illustration

Assignment Submission

1. Internet will remain on only for the last 30min OR files will be collected through USB drives.
   a) Mail your submission to enggdrawingiitkgp@gmail.com
2. Subject line of the mail and file names should contain
   a) Session Code like 1cad / 2cad / 3cad / examcad
   b) Roll Number
   c) Problem Number
   d) Name
3. Ex: 1cad12ae10099prob1?anupghosh.????
4. Collect your work and delete it from the computer.
5. No late submission will be accepted.